

## THE FERN GENUS CHEILANTHES IN CONTINENTAL UNITED STATES

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Ever since *Cheilanthes* was described by Swartz in 1806, botanists have had great difficulty in delimiting the genus. It is clearly part of a large complex in which the species are fairly distinct but the generic limits are unclear. Customarily three larger genera have been recognized--*Cheilanthes*, *Notholaena*, and *Pellaea*--and occasionally several small splinter genera have been recognized as well. However, there is a great problem in distinguishing *Cheilanthes* from *Notholaena* and to a lesser extent from *Pellaea*. It is the purpose of this paper to examine the distinction between *Cheilanthes* and *Notholaena*.

Classically, *Cheilanthes* has been distinguished from *Notholaena* by the former having a recurved, differentiated margin to protect the sori, whereas *Notholaena* possesses a plane or slightly recurved, undifferentiated margin (many authors, including Cronquist et al., 1972; Dittmer et al., 1954; Knobloch and Correll, 1962; Munz, 1965). In preparing keys to the ferns of the United States, it has become quite clear to me that the two genera cannot in fact be distinguished using this character. Careful examination of the species of *Cheilanthes* and *Notholaena* shows that many species of *Cheilanthes* in fact do not have a well differentiated margin. Frequently, the margin curves back slightly without developing a false indusium and does not cover the sori. In most species of *Notholaena*, the margin curves back in precisely the same manner. In the northwestern United States, for example, *Notholaena parryi* is distinguished on the margin character from *Cheilanthes feei* (Cronquist et al., 1972), but the margins are so covered with hairs that only careful observation will show that the margins of both species are the same. Another anomaly lies in that *Cheilanthes cooperae* has never been placed in *Notholaena* even though its margin is almost perfectly plane and entirely undifferentiated.

Efforts have been made to find additional characters, such as stipe and blade anatomy, hairs, spore morphology, and chromosome numbers (Knobloch, 1969; Knobloch et al., 1975; Knobloch and Volz, 1964, 1968; Lellinger, 1965; Tryon and Tryon, 1973), but none have been found. A basic problem seems to lie in the assumption that *Notholaena* and *Cheilanthes* are indeed separate genera and that therefore there are characters to be found to distinguish them. I think this is a misconception. I have examined the plants thoroughly and can find no character that will support the maintenance of *Notholaena* as commonly circumscribed. Rather, I see distinct groups of species that can be

defined on characters of the rhizome scales, blade indument, stipe and rachis anatomy, and to a lesser extent the nature of the margin. Since I cannot find any characters that will adequately distinguish *Notholaena* from *Cheilanthes*, I can see no rational recourse other than to combine the two.

There are, as mentioned above, several species groups that are fairly distinct, and some of these groups have already been given generic recognition. *Adiantopsis*, with its very short, discrete sori, is very distinct in the form of one species, *A. radiata*, but other species, such as *A. chlorophylla*, approach *Cheilanthes* in their form. *Mildella*, with its inframarginal sorus, is somewhat distinct. *Aspidotis*, although it has discrete, short sori in three species, the other and most widespread one, *A. densa*, has a continuous sorus along the margin, the only character holding the genus together being the shiny, elongated cells in the upper epidermis, a character not unique to this group. *Aleuritopteris* is largely represented by the widespread *A. farinosa*, supposedly distinguished by its waxy lower surface and well developed false indusium. Several species of *Notholaena* (*N. candida* et aff.) have much the same architecture and anatomy and, though lacking the false indusium of *A. farinosa*, are probably allied to it. *Sinopteris* is distinguished from *Cheilanthes* and *Aleuritopteris* on the basis of having only one sporangium at the end of each vein. The veins that run parallel to the segment margins, however, have two or three sporangia, and other groups of *Cheilanthes* have a tendency toward low numbers of sporangia, so the justification for upholding *Sinopteris* is rather tenuous.

The cheilanthoid complex appears to be one in the process of early generic separation. Evolution has not isolated them enough yet nor made them distinct enough to make genera clear-cut. There are grounds both for lumping the entire complex or splitting off several groups with intermediates between most groups. However, the current status of separating a broad *Notholaena* does not seem to be one of the options. We have a large complex with many lobes. *Notholaena* in its strict sense includes only those which are strongly scaly on the lower blade surface and are not finely divided--e.g., *N. marantae*, *N. sinuata*, et aff. To include the waxy backed species or the very hairy species is to include representatives of other lobes of the complex which probably are not closely allied. Certainly such hairy species as *Notholaena parryi*, *N. newberryi*, and *N. jonesii*, are much closer to *Cheilanthes feei* and *C. lanosa*, the supposed differences in the margin notwithstanding.

In the cyatheoid tree ferns it was found that the loss of indusium (*Alsophila*) or partial loss (*Hemitelia*) had occurred independently several times and the genera were artificial. Holttum and Sen (1961) lumped them all back into *Cyathea*, point-

ing out several natural groups within it. Tryon (1970) then developed the evidence for separating six genera based on characters other than the sorus, largely of the indument. The situation in *Cheilanthes* is much the same. The current broadly construed *Notholaena* is unnatural, and the first step to provide a rational taxonomy of the complex is to combine it with *Cheilanthes*. It would be premature to carve out additional splinter genera until more detailed work on individual species groups is accomplished.

Below is a list of the North American species of *Cheilanthes* (north of Mexico) with some basionyms and common synonyms.

*Cheilanthes aemula* Maxon

*Cheilanthes alabamensis* (Buckl.) Kunze

CHEILANTHES ALIENA (Maxon) Mickel, comb. nov.

*Notholaena aliena* Maxon, Contrib. US. Nat. Herb. 17: 605. 1916.

CHEILANTHES ARIZONICA (Maxon) Mickel, stat. nov.

*Cheilanthes pyramidalis* ssp. *arizonica* Maxon, Amer. Fern J. 8: 116, pl. 6. 1918.

*Cheilanthes aschenborniana* (Kl.) Mett.

*Notholaena aschenborniana* Kl.

*Cheilanthes bonariensis* (Willd.) Proctor

*Notholaena aurea* (Poir.) Desv.

*Cheilanthes californica* (Hooker) Mett.

CHEILANTHES CANCELLATA Mickel, nom. nov.

*Notholaena fendleri* Kunze, Farnkr. 2: 87, t. 136. 1851.

*Cheilanthes candida* Mart. & Gal. var. *candida*

*Notholaena candida* (Mart. & Gal.) Hooker

CHEILANTHES CANDIDA var. COPELANDII (C.C. Hall) Mickel, comb. nov.

*Notholaena candida* var. *copelandii* C.C. Hall, Amer. Fern J. 40: 181, t. 16. 1950.

*Cheilanthes carlotta-halliae* W.H. Wagner & Gilbert

*Cheilanthes clevelandii* D.C. Eaton

CHEILANTHES COCHISENSIS (Goodd.) Mickel, comb. nov.

*Notholaena cochisensis* Goodd., Muhlenbergia 8: 93. 1912.

*Cheilanthes cooperae* D.C. Eaton

*Cheilanthes covillei* Maxon

*Cheilanthes dealbata* Pursh

*Notholaena dealbata* (Pursh) Kunze

CHEILANTHES DESERTI Mickel, nom. nov.

*Notholaena californica* D.C. Eaton, Bull. Torr. Bot. Club 10:  
27. 1883.

*Cheilanthes eatonii* Baker ex Hooker & Baker

*Cheilanthes feei* Moore

*Cheilanthes fendleri* Hooker

*Cheilanthes fibrillosa* Davenp. ex Underw.

*Cheilanthes gracillima* D.C. Eaton

*Cheilanthes grayi* (Davenp.) Domin

*Notholaena grayi* Davenp.

CHEILANTHES GREGGII (Mett. ex Kuhn) Mickel, comb. nov.

*Pellaea greggii* Mett. ex Kuhn, Linnaea 36: 86. 1869.

*Notholaena greggii* (Mett. ex Kuhn) Maxon

*Cheilanthes horridula* Maxon

CHEILANTHES INTEGERRIMA (Hooker) Mickel, comb. nov.

*Notholaena sinuata* var. *integerrima* Hooker, Sp. Fil. 5: 108.  
1864.

*Notholaena integerrima* (Hooker) Hevly

*Cheilanthes intertexta* (Maxon) Maxon

CHEILANTHES JONESII (Maxon) Mickel, comb. nov.

*Notholaena jonesii* Maxon, Amer. Fern J. 7: 108. 1917.

*Cheilanthes kaulfussii* Kunze

*Cheilanthes lanosa* (Michx.) D.C. Eaton

*Cheilanthes lemmonii* (D.C. Eaton) Domin

*Notholaena lemmonii* D.C. Eaton, Bull. Torr. Bot. Club 7: 63.  
1880.

*Cheilanthes lendigera* (Cav.) Sw.

*Cheilanthes leucopoda* Link

CHEILANTHES LIMITANEA (Maxon) Mickel var. LIMITANEA, comb. nov.

*Notholaena limitanea* Maxon, Amer. Fern J. 9: 70. 1919.

CHEILANTHES LIMITANEA var. MEXICANA (Maxon) Mickel, comb. nov.

*Notholaena limitanea* ssp. *mexicana* Maxon, Amer. Fern J. 9: 72. 1919.

*Cheilanthes lindheimeri* Hooker

*Cheilanthes microphylla* Sw.

*Cheilanthes nealleyi* (Seaton ex Coulter) Domin var. *nealleyi*

*Notholaena schaffneri* var. *nealleyi* (Seaton ex Coulter) Weath.

*Notholaena nealleyi* Seaton ex Coulter

CHEILANTHES NEALLEYI var. MEXICANA (Davenp.) Mickel, comb. nov.

*Notholaena nealleyi* var. *mexicana* Davenp., Bot. Gaz. 16: 54. 1891.

*Notholaena schaffneri* var. *mexicana* (Davenp.) Davenp.

*Notholaena schaffneri* (Fourn.) Underw. ex Davenp.

*Aleuritopteris schaffneri* Fourn., Bull. Soc. France 27: 328.

1880; not *Cheilanthes schaffneri* Moore, 1861, which was a renaming of *Myriopteris rufa* Fée.

CHEILANTHES NEGLECTA (Maxon) Mickel, comb. nov.

*Notholaena neglecta* Maxon, Contrib. U.S. Nat. Herb. 17: 602. 1916.

*Cheilanthes newberryi* (D.C. Eaton) Domin

*Notholaena newberryi* D.C. Eaton

*Cheilanthes notholaenoides* (Desv.) Maxon

*Cheilanthes* X *parishii* Davenp.

*Cheilanthes parryi* (D.C. Eaton) Domin

*Notholaena parryi* D.C. Eaton

CHEILANTHES PARVIFOLIA (R. Tryon) Mickel, comb. nov.

*Notholaena parvifolia* R. Tryon, Contrib. Gray Herb. 179: 98.

1956, which is in turn based on *Pellaea microphylla* Mett.

ex Kuhn, Linnaea 36: 86. 1869, not *P. microphylla* Fée, nor

*Notholaena microphylla* Bolle, nor *N. microphylla* (Sw.) Keys.

which is *Cheilanthes microphylla* Sw.

*Cheilanthes pringlei* Davenp.

*Cheilanthes siliquosa* Maxon

*Cheilanthes sinuata* (Lag. ex Sw.) Domin

*Notholaena sinuata* (Lag. ex Sw.) Kaulf.

CHEILANTHES STANDLEYI (Maxon) Mickel, comb. nov.

*Notholaena standleyi* Maxon, Amer. Fern J. 5: 1. 1915.

*Cheilanthes tomentosa* Link

*Cheilanthes villosa* Davenp. ex Maxon

*Cheilanthes viscida* Davenp.

*Cheilanthes wootonii* Maxon

*Cheilanthes wrightii* Hooker

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